A Minimized Architecture for Transmitting High-rate Data through a Small Antenna

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As the wireless communication devices shrink in size, transmission bandwidth becomes a challenging factor for antenna designers. For example, biomedical implants are among the most critical devices that are required to have a minimized size while transmitting high data-rate information. Particularly, devices that interact with the nervous system such as cochlear and visual prostheses must be able to transmit a large amount of data in order to provide a high-resolution sensing for the user. Even though a high data-rate can be achieved by increasing the carrier frequency in broadband systems, in low-frequency applications high-bandwidth data-transmission remains as a challenging requirement. Furthermore, power consumption and the overall size of the device is a key point in many wireless units such as biomedical implantable devices.

In this demonstration, we present a new technique to realize a wideband data-transmission through miniaturized antennas using the antenna transient mode. Since small antennas operate in single mode, a short-pulse input current can be used to excite the fundamental resonance of the antenna. We show that if the antenna has a sufficiently high Q factor, we can tune the resonant frequency in a time-varying fashion and realize a fast frequency shift-keying modulation. The excitation mechanism is provided by a switching system along with a DC power supply. If the ON and OFF time of the switch is short, we can excite the tuned fundamental resonant frequencies of the antenna and maintain a high amount of radiation power while antenna operates in the transient mode. Depending on the damping factor of the radiated fields, switching frequency can be increased and therefore, a fast FSK transmission can be implemented by using a high-Q antenna. Carrier frequencies are generated based on inherent transient properties of the antenna and the need for VCO is obviated. The proposed method directly utilizes the DC power supply to provide the radiation power with minimum number of components and hence, the overall size of the transmitter is reduced. Experimental results will be presented in order to validate the presented technique.